THE DRIFT OF THE « SEDOV » (*)

by

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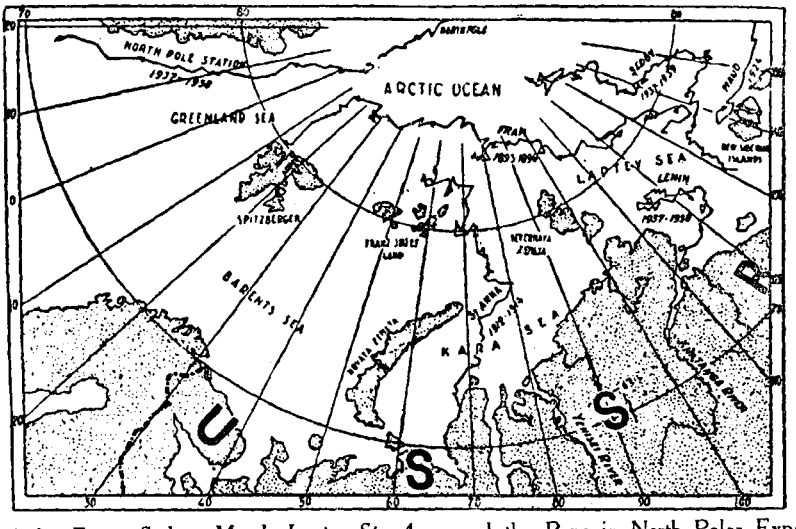
The scientific importance of the drift of the *Sedov* is comparable to that of the *Fram* or of the Papanin North-Polar Expedition on the drifting icefloe of 1937-38. Certain circumstances make the drift of the icebreaker specially interesting from a theoretical and practical point of view. First, the *Sedov*, together with the icebreakers *Sadko* and *Malygin*, began to drift in the Laptev Sea at lat. 75° 91' N. and long. 132° 25' E. on October 23, 1937, that is, while the Papanin Expedition was still working. Thus we have had the movement of the ice in the Artic Basin under continuous observations since May 21, 1937, the date when the Papanin Expedition began its drift.

Secondly, a convoy of freighters, escorted by the icebreaker *Lenin*, was carried away by the ice from Khatanga Bay at the beginning of November, 1937, that is, soon after the commencement of the drift of the *Sadko, Malygin* and *Sedov*. These vessels drifted in the southwestern part of the Laptev Sea until August 7, 1938, when they were freed by the icebreaker *Krassin*, which cut a passage through the ice.

Two groups of vessels were thus drifting with the ice simultaneously at some distance from each other for the space of nine months, one group in the southwestern part of the Laptev Sea and the other in the north-eastern part of the same sea, north of the New Siberian Islands.

As is seen from the accompanying map, the drifts of the *Sedov* and the *Lenin* groups, although differing in detail, are remarkably similar. The *Sedov* is being carried approximately through the same region as Fridtjof Nansen's expedition of 1893-96 on the *Fram*.



Drift of the *Fram, Sedov, Maud, Lenin, St. Anna* and the Papanin North Polar Expedition

(*) The Soviet ice-breaker *Sedov* became ice-bound on October 23, 1937, in lat. 75° 21' N. long. 132° 15' E., near the New Siberian Islands. Attempts to free her last autumn failed, but some of her crew were exchanged with men from the rescue vessel *Ermack*. The *Sedov* is provisioned for several years and has fifteen men on board. On February 20, 1939, she was in lat. 86° 2' N., long. 119° 5' E., a little more than two hundred and fifty miles from the North Pole.

A comparison of the drifts of the *Sedov* and the *Lenin* on one hand, and of those of the *Sedov* and the Papanin Expedition on the other, and finally a comparison of the drifts of the *Sedov* and the *Fram*, are of great scientific and practical value. The comparison of the drifts of the *Sedov* and the *Fram* is of particular interest because, as is known, climatic conditions have changed considerably since Nansen's time. As is evidenced by many facts, the atmosphere and hydrosphere in the Arctic have now become much warmer.

An examination of all the peculiar features of the Sedov's drift will only be possible after all the data collected have been carefully studied ; but from data already available, it is possible even now to draw some important conclusions.

An important achievement of the *Sedov* has been the final destruction of the legend of « Sannikov Land ». This alleged land derived its name from a Russian hunter named Sannikov who, in 1811, observed high land to the north of Kotelny Island but failed to reach it. Toll, a well-known Russian traveller, on the occasion of two visits to the New Siberian Islands made in 1886 and 1894, saw the land and even distinguished on it four high mountains, of which he drew the contours, and his guides, too, assured Toll that they had seen this land on more than one occasion.

Afterwards, several Arctic expeditions endeavoured to find this mysterious land. They were the 1900-3 expedition of the *Zarya* under Toll, the expeditions of 1913 and 1914 on the icebreakers *Taimyr* and *Vaigach*, which discovered Severnaya Zemlya, and the Norwegian expedition on the *Maud* in 1924. « Sannikov Land » was not sighted during any of these voyages, but this did not necessarily disprove its existence. None of the aforementioned vessels succeeded in going beyond the limits of the shallow waters of the continental shelf, while sailing north of the New Siberian Islands. So long as this shelf had not been adequately explored it was always possible that an island of continental origin might be found.

One of the objectives of the high latitude expedition on the icebreaker *Sadko* in 1937 was to search for « Sannikov Land ». The *Sadko* on that occasion went northwards along the Kotelny Island meridian, and then eastward a little below the 78th parallel, approximately as far as the Bennett Island meridian. She then sailed to Henrietta Island. No trace of « Sannikov Land » was found.

Now, during the drift of the *Sedov*, the region to the north of the New Siberian Islands was crossed on two more occasions — once from west to east and then from the south-east to the west. Moreover, the icebreaker has proceeded beyond the limits of the continental shelf.

The air expedition under A. Alexeyev made six flights across that region from Cape Kotelny last spring, when engaged in removing part of the crews from the *Sadko*, *Sedov* and *Malygin*, which were then still drifting together. Visibility was excellent on each occasion, but nothing was seen of the mysterious « Sannikov Land ». The legend of « Sannikov Land » has now been finally exploded.

The second important geographical achievement of the *Sedov* is her exploration of the continental shelf and the slope down to the great depths of the Arctic Ocean.

Prior to the Nansen expedition there was no knowledge of the central part of the Arctic Ocean. Soon after he entered the ice north-west of the New Siberian Islands, Nansen found a depth of 1,600 metres, approximately at lat. 78° N. and long. 134° E. A subsequent sounding taken approximately at lat. 80° 50' N. and long. 126° E. showed the depth to be 3,850 metres, which was the deepest sounding taken by Nansen during his expedition.

These soundings established a deep-water basin. Hence, the determination of the boundaries of the continental shelf of the Arctic Ocean become one of the most important objectives of every expedition sent out to the central part of the Arctic.

The boundary of the continental shelf was established by the Papanin Expedition near the north-east coast of Greenland ; by the expedition on the *Sadko* in 1935, near the northern part of the Kara Sea, where a sounding taken at lat. 82°42' N. and long. 87° 4' E. showed a depth of 2,365 metres ; and by the 1937 expedition of the *Sadko* in the Laptev Sea, where a sounding taken at lat. 77° 34'

N. and long. 118° 28' E., showed a depth of 2,381 metres ; and finally, during the drift of the *Sedov*.

The data obtained by the *Sedov* are very characteristic. The continental shelf in the region of the New Siberian Islands was shown to stretch farther north than had been supposed. Moreover, the continental slope proved exceedingly gradual ; it stretches nearly 120 kilometres in a northerly direction, and its gradient is only between two and three degrees.

The observations carried out by the *Sedov* during her drift have made it possible once again to verify and to establish the fact that the direction and speed of the drift depend on the direction and velocity of the wind.

Like all previous drifts of icebound vessels and of the icefloe of the Papanin Expedition, the drift of the *Sedov* did not proceed in a straight line. The ice-breaker quite frequently veered to one direction, turned back on her course, and described zigzags or even loops.

These changes in the direction of the drift are due to the changes of the wind, to which the icefields respond very rapidly. As Nansen had discovered and explained, the direction of the icedrift in the central part of the Arctic Ocean, owing to the action of the deflecting force of the earth's rotation, deviates approximately 40° to the right from the direction of the wind blowing at a given moment over the ice. The speed of the drift is approximately one-fiftieth of the velocity of the wind. The *Sedov's* drift, too, has been subject to this law.

The accompanying diagram shows the remarkable similarity between the course of the wind and the course of the *Sedov*. Where the course of the wind is even, the drift proceeds approximately in the same direction, the only difference being that the drift is turned approximately 40° to the right. Where the wind changes sharply, the *Sedov*, too, begins to describe zigzags and loops. Very characteristic, in this respect, are the figures of eight described by the wind and the *Sedov* between October 2 and October 25 of the last year, the zigzags between November 10 and November 30, 1938, and the loops between December 17, 1938, and January 17, 1939.

An examination of available data relating to the Central Polar Basin shows that there is either no constant current in the regions of the *Sedov* drift or, if such a current exists, it is so negligible as scarcely to have any effect on the future movement of the vessel. Wind conditions will play the principal role.

The prevailing winds during the drift of the icebreaker have been south-easterly. From September 1, 1938 to February 1, 1939, a moderate wind blew from the south-east at a velocity of about two metres per second. From this it follows that the *Sedov* is on the edge of a polar anti-cyclone, the centre of which is somewhere to the nort-east of the vessel.

The *Sedov's* drift during the first half of last December was exceptional. At that time the vessel was under the influence of westerly and south-westerly winds. In other words, she was on the southern edge of cyclones sweeping into the central Arctic between her and the North Pole.

The North Polar Expedition of Papanin was the first to establish that these cyclones break through into the central part of the Arctic. However, they are much more likely to occur there in the first half of the winter than in the second. Hence, it may be presumed that the *Sedov* will not again be affected by such before the polar summer begins and that she will continue to drift in a north-north-westerly direction during the next two or three months.

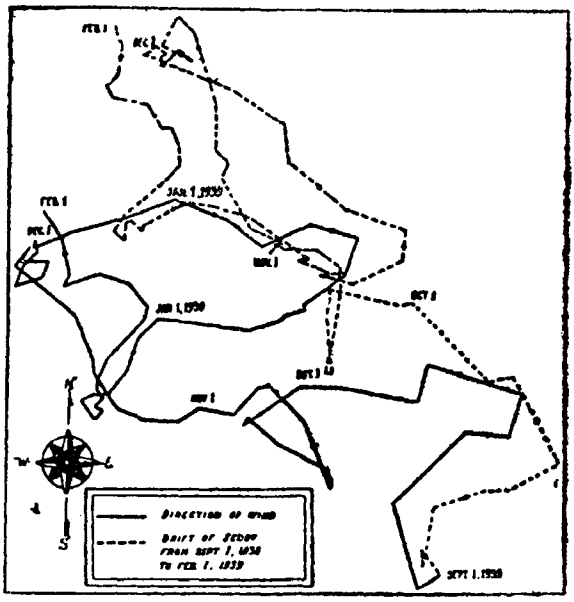
Owing to insufficient data, there is as yet no certainty as to the way is which the ice in the central part of the Arctic Ocean moves. Some Arctic explorers are of the opinion that in general the drift of the ice proceeds simply from the seas of the Soviet Arctic, first northward and then westward, to the strait between Greenland and Spitsbergen, and also from the shores of Alaska in a straight line across the North Pole to the Greenland Sea.

The famous drifts of the *Jeannette* (1879-81), the *Fram* (1893-96), the *Karluk* (1913-14) and the *Maud* (1922-24), which took place near the continental slope in the central Arctic, are confirmation of this view. The way in which the icefloe of the

Papanin North Polar Expedition (1937-38) was carried almost in a straight line from the Pole to the north-eastern coast of Greenland also fitted in with this view.

However, from the time of Toll's expedition of 1900-3, a theory has existed that besides the general movement of the ice from east to west, under the influence of a given system of winds there is a circular movement of the ice in a clock-wise direction. This movement is supposed to have its centre near the « pole of inacessibility », which is situated between lat. 83° and 85° N., approximately on the meridian of Bering Strait.

It may be assumed that the icefloe of the Papanin North Polar Expedition during its drift was on the eastern edge of the Greenland area of high atmospheric pressure and on the western boundary of the trough of low pressure created as a result of Atlantic cyclones breaking through into the Arctic. The *Sedov*, it seems, is on the western edge of the North American area of high pressure and on the eastern boundary of the trough of low pressure passing through the Arctic in the vicinity of the North Pole.



Direction of wind and drift of *Sedov* compared

The low figure obtained for the speed of the constant current by a study of the *Sedov's* drift does not seem to contradict these suppositions. Occasional but strong winds in one or other direction may draw the *Sedov* either into a drift similar to that of the Papanin icefloe or into a drift around the « pole of inaccessibility ». This view was expressed by the present writer as early as the beginning of last December, and the data so far received from the vessel do not contradict it.

Another circumstance must be taken into account in connexion with these suppositions. The ice around the *Sedov* differs appreciably in its nature and movement from that observed by Soviet airmen at the North Pole. The vessel is surrounded by comparatively young ice (about two or three years old), small fields with a considerable quantity of hummocky ice prevailing. In the region of the North Pole, old comparatively level fields were the most common. At least a year or more is necessary for the *Sedov* ice to be transformed into fields of this kind.

When flying from Franz Josef Land to the North Pole, the Soviet airmen first saw a belt of comparatively young ice. This was followed near lat. 86° N. by a peculiar belt of humocky or jagged ice, the origin of which has not been sufficiently studied. Level fields of old ice stretched beyond this belt to the Pole itself.

To judge by the data at our disposal, the *Sedov* is in the belt of hummocky ice situated between the main mass of Arctic ice and the ice carried comparatively recently into the central basin from the seas of the Soviet Arctic. This would explain the constant movement and jamming of the ice observed by the *Sedov* expedition.

Finally, it is possible that the belt of hummocked ice stretches along the trough of low pressure created by the inrush of masses of Atlantic air into the Arctic. This is all the more probable since the passage of this air is usually accompanied by powerful winds.

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